A TERTIARY LATITE SILL NEAR CHICKEN CREEK, JUAB COUNTY, UTAH.

A Thesis

Presented in Partial Fulfillment of the Requirements

For the Degree Bachelor of Science

By

James Robert Waltz

The Ohio State University

1974

Approved by:

David H Elliot

Adviser

Dept. of Geol. and Miner.

Contents

	Page
Introduction	1
General Statement	1
Location	2
Tertiary Latite Sill	4
Field relationships	4
Petrography	7
Macroscopic	7
Microscopic	8
Acknowledgements	10
Appendix	13
Illustrations	
Figure 1. Location map	3
Figure 2. Percent compositional chart	11
Plate 1a. View of sill	5b
Plate 1b. View of sill	5b
Plate 2. View of columnar jointing	6b
Plate 3. Photo-micrograph of the contact of the sill and the country rock	20b
Plate 4a. Photo-micrograph of an average specimen	21b
Plate 4b. Same	21b
Plane Table Map	

Introduction

General Statement

This field of study was undertaken by the writer during the summer of 1973, at which time the field work, plane table mapping, and sample collecting were completed. The only previous work on the sill was an investigation by John(1970). The sill was reinvestigated in order to extend the earlier work in which the petrography was described only briefly.

Zeller(1949), first described the rocks on the Gunnison Plateau and reported an igneous intrusion three miles south of Chicken Creek as a monzonite porphyry.[1] Hunt(1950) and John(1972) confirmed and added to this report by mapping and studying igneous rocks of this type throughout the Gunnison area.

Twenty-eight stocks and sills crop out within a five mile radius of Chicken Creek sill. John(1972) hypothesizes five different series of intrusions of varying composition with the sill under study, a leucomonzonite, belonging to the fourth youngest of the series. Age and compositional relationships suggest that the Gunnison igneous rocks were all intruded within a relatively short period of time in the late Eocene. Mckee(1971) in his work of the Great Basin suggested that a lithospheric plate, the Farallon plate, was overidden by the North American plate which subsequently caused eruptions of andesitic to rhyolitic composition.

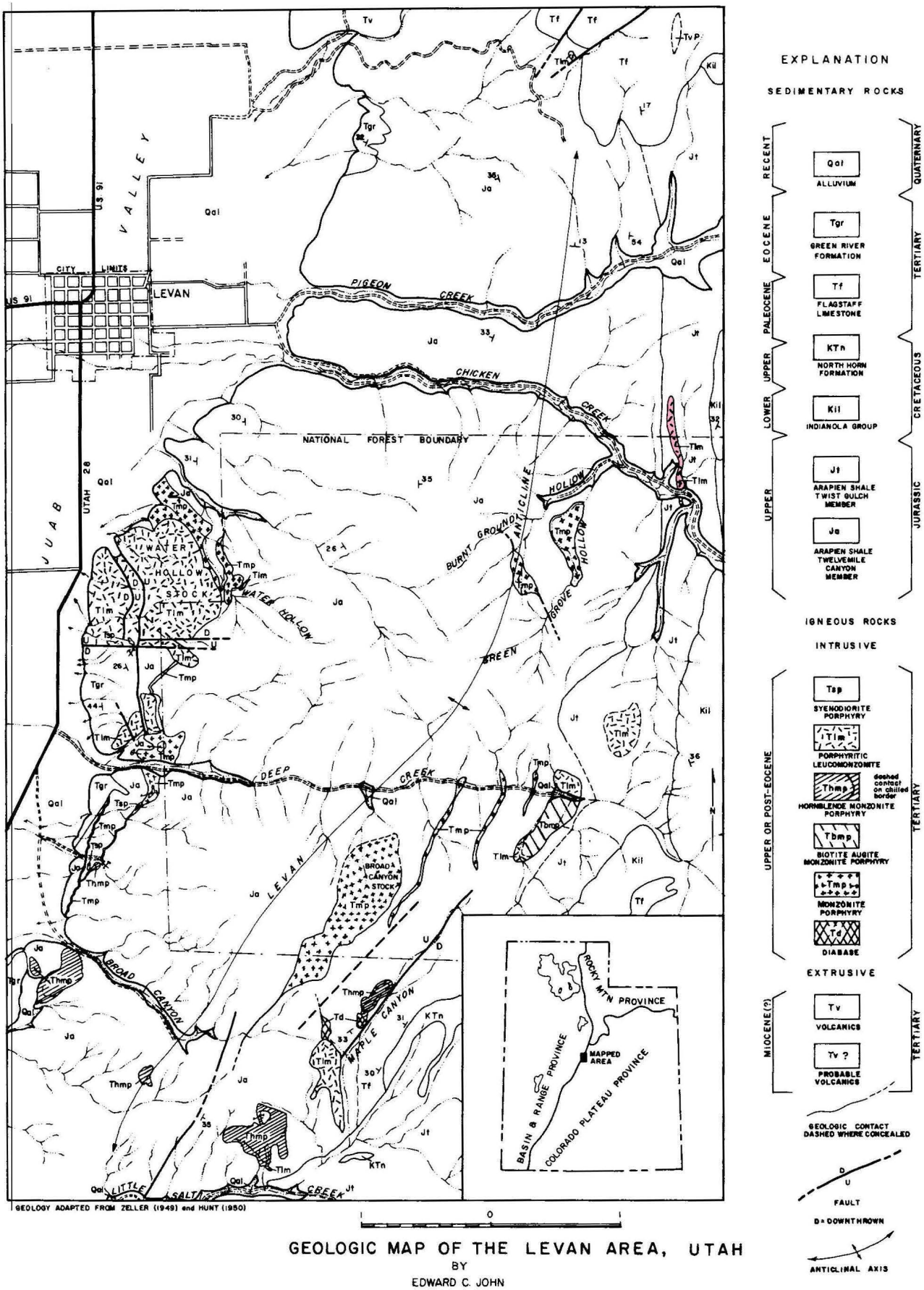
---

[1]See beginning of petrography section for classification discussion.

These eruptions occurred in the late Eocene or forty million years ago. Two different authors agree with this evidence, Hunt(1950) and Armstrong (1970), although hard evedence is only given by the latter. Armstrong dated the biotite of a tuff at Chicken Creek by the K-Ar method as 35±.7 my. The date of the extrusive, he continues, is younger or contemporaneous with intrusions in the same area.

Location

The sill is located near Chicken Creek four and one quarter miles east-south-east of Levan. Specifically, the sill crops out just north of Chicken Creek, Utah within the Nephi 15 minute Quadrangle, Juab County, T.14S.-T.15S.; R.1E.-R.2E.; SW¼ SW¼ sec. 36 and E.½ NW¼ sec. 2. See Figure 1. for location.



GEOLOGIC MAP OF THE LEVAN AREA, UTAH

BY

EDWARD C. JOHN

Figure 1

A Tertiary Latite Sill

Field Relationships

The sill (plates 1a,b) is a porphyritic latite which intruded the lower Jurassic Twist Gulch, Zeller(1949) and Hunt (1950). At the surface the sill is approximately 3800 feet in length and varies in width from 0 to 150 feet. At the northernmost end the sill dips underground and does not reappear. At the southernmost end, the sill goes underground but is possibly connected with a dike on the south side of Chicken Creek. The sill strikes N.45E. dipping 38E. which is concordant with the surrounding beds. John(1972) states that the sill is emplaced into the eastern limb of the Levan Anticline. The local structure was formed prior to the intrusion . The intrusion itself can be classified as hepabyssal through several lines of evidence. Columnar joints (plate 2), a miarolitic texture to the rocks, and alpha quartz are all distinctive of shallow intrusions and extrusive rocks (Hyndman 1972).

The country rock surrounding the will is predominately a yellow, medium grain, friable sandstone with calcite cement. There is some green-gray clay present along the lower contact. This has been incorporated into the sill in a few places as xenoliths up to 7.5mm. sq. The contact of the sill and Twist Gulch in very clean showing a macroscopic metasomatic zone of no more than two centimeters. This zone resembles a silicic rock, although microscopic shows little or no evidence

Plate 1a. View of Latite Sill(Tl) looking northerly. (Jtg) Jurassic Twist Gulch underlying.

Plate 1b. Viewing the north end of the sill looking East with (Jtg) Jurassic Twist Gulch underlying.


Jtg
TL
AUG 73


TL
Jtg
AUG 73

Plate 2. A view of the columnar jointing of the sill looking dip-normal.


AUG 73

of alteration.

A small topographical inversion at the sill has occurred due to differential weathering. The eastern slope is Jurassic Twist Gulch covered with talus from the sill, while the west slope is a dip slope also talus covered.

Petrography

Prior to giving macroscopic and microscopic descriptions of the sill, a short discussion of classification is needed for clarification. Zeller(1949), Hunt(1950) and John (1972) have called the sill a porphyritic monzonite or leucomonzonite. I think this term is misleading as to texture and depth of intrusion. The texture is aphanitic porphyritic and the intrusion is most probably hypabyssal for reasons I stated in field relationships. Using the volcanic classification given in Hyndmann(1972), I classify the sill as a porphyritic latite, dropping the prefix leuco- as being redundant.

Macroscopic Description

Hand specimens from the sill are a light tan or gray porphyritic latite containing 10% phenocrysts of white euhedral plagioclase and black subhedral biotite in equal amounts. Phenocrysts average 1.5mm on a side with the largest being greater than 3mm on a side. Trace minerals are subhedral black hornblende and prismatic quartz crystals showing growth striations on the rhombohedral faces. The quartz is often found in miarolitic cavities. Specimens show surface weather-

ing to a yellow and brown mineral, probably limonite and kaolinite, which penetrates the rock surface to several mm.

Microscopic Observations

A detailed description of each petrographic slide can be located in the appendix along with its relative location on the outcrop. Also photo-micrographs of several slides and their explantions can be seen at the end of the appendix.

The following text is taken from John's(1972) analysis concerning the sill at Chicken Creek:

> "...The texture is holocrystalline porphyritic... The plagioclase phenocrysts are.. andesine, composition $An_{32}Ab_{68}$, in [the sill] The plagioclase phenocrysts have normal and oscillatory zoning, albite and carlsbad twinning, a size range from one-fourth mm to three mm and comprise seven to ten percent of the section... Biotite phenocrysts average one mm in size and two percent of the section. The groundmass is composed of fine-grained oligoclase or andesine and orthoclase. Size of the minerals in the groundmass make identification and separation of the feldspars difficult. Quartz forms three to four percent of the groundmass and is partly resorbed. Embayments in the quartz indicate that it was out of equilibrium at the time of intrusion. Accessory minerals are apatite, titanite, magnetite, and hematite. Much of the hematite is the result of alteration of the ferromagnesium minerals... Rock alteration consists of sericitation, kaolination and carbonation plus the change of the ferromagnesium minerals in part to hematite. Samples of fresh rock have less than five percent alteration, whereas surface outcrops show up to ten percent."

My analysis of the sill differs only slightly from that of John's analysis above. The results I observed will be reported in the same sequence of facts as they were stated in the

in the preceding excerpt. The texture is porphyritic aphanitic; my samples show approximately ten percent of the rock to be phenocrysts of which four percent are biotite. The groundmass is holocrystalline porphyritic but changes to cryptocrystalline near contact areas. The mature plagioclase phenocrysts are $An_{41}Ab_{59}$ with the average composition of eleven samples being $An_{32}Ab_{68}$. Normal and oscillatory zoning is evident in most plagioclase phenocrysts and in parts of the groundmass; albite and carlsbad twinning of the crystals is common also. Plagioclase represents five percent of the phenocrysts, biotite four percent, and quartz one to two percent. Phenocrysts range in size from 4mm to ¼mm long. The biotite occurs in light-green to red-brown laths and often has apatite or zircon inclusions. Differential alteration to calcite, sericite, and hematite along cleavages is the outstanding feature. Quartz phenocrysts are found adjacent to feldspars and are commonly intergrown with them. Most anhedral crystals show vacoules in them.

The groundmass appears to be made of orthoclase and plagioclase (composition uncertain but probably oligoclase.) Accessory minerals observed are magnetite, opaques, hematite, apatite, zircons, and what appears to limonite.

Alteration in the sill occurs in two different regions. In areas where the sill is adjacent to the calcite cemented country rock, calcite and hematite alteration dominates. Within the interior of the sill, sericite and hematite alteration dominate. The alteration procusts form pseudomorphs of some

of the crystals they replace. Weathering of the sill appears restricted to limonitization.

Acknowledgement

I would like to express my gratitude to the following individuals: to Dr. David H. Elliot, my adviser, without whose help and stimulation I would not have completed the study; to Dr. George E. Moore, who informed me of the project; to Mike Costello, who helped in plane tabling the outcrop; to Bob Wilkinson of the Geol. Dept. for the photo-micrographs; to the Friends of Orton Hall for funds for thin sections; and finally to The Ohio State Uneversity for its transportation and library services.

Mineral Composition by Percent of the Igneous Rocks

	Or	An	Q	Bi	Mg	Hm	Ap	Zr	Ca	Se	Li
John	37	55	1	2		2	1		2		1
Waltz	38	52	2	4	<1	1	T	T	<1	<1	<1

Or= orthoclase
An= andesine
Q= quartz
Bi= biotite
Mg= magnetite
Hm= hematite
Ap= apatite
Zr= zircon
Ca= calcite
Se= sericite
Li= limonite

Bibliography

Armstrong, R. S., 1970, Geochronology of Tertiary Igneous Rocks, Eastern Basin and Range Province, Western Utah, Eastern Nevada, and Vicinity : Geochim. Cosmochim. Acta. v. 34, p. 203-232.

Compton, R. R., 1962, Manual of Field Geology, New York, John Wiley & Sons, Inc., 378p.

Hunt, R. E., 1950, Geology of the Northern Part of the Gunnison Plateau, Utah : The Ohio State University, unpub.-Ph.D. thesis, 267p.

Hyndman, W. D., 1972, Petrology of Igneous and Metamorphic rocks, McGraw-Hill Book Co., 538p.

John, E. C., 1972, Petrology and Petrography of the Intrusive Igneous Rocks of the Levan Area, Juab County, Utah, Kennecott Copper Corporation, Salt Lake City, Utah, 10p.

McKee, E. H., 1971, Tertiary Igneous Chronology of the Great Basin of the Western United States--Implications for Tectonic Models : Geol. Soc. Amer., Bull., v. 82, p. 3497-3502.

Zeller, H. D., 1949, Geology of the West Central Portion of the Gunnison Plateau, Utah : The Ohio State University, unpub. M.S. thesis, 83p.